

IN THE CLAIMS:

Please amend Claims 1, 17, 34-36 and 42 and add new Claims 90-92 as follows.

1. (Currently Amended) An image recording method for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel with a [one of N] gradation ~~values~~ value, said method comprising the steps of:

an input step for inputting image data including gradation-value information and position information relating to each pixel;

a ~~first~~ selection step for selecting one dot-pattern ~~table~~ based on gradation-value information and position information indicated by each pixel of the image data input in said input step, from ~~among N a dot-pattern tables, each table~~ having a plurality of different dot patterns associated with gradation value and pixel position, ~~corresponding to respective ones of the N gradation values; and~~

~~a second selection step for selecting one dot pattern based on position information indicated by the pixel from the dot-pattern table selected in said first selection step;~~  
and

a recording step for recording an ink dot based on the dot pattern selected in said ~~second~~ selection step on a recording medium using a recording head,

wherein the dot pattern table has a plurality of different dot patterns, each having the same dot number and a different dot arrangement, corresponding to same gradation value, and

wherein the plurality of different dot patterns corresponding to the same gradation value are associated with a plurality of pixel positions corresponding to a plurality of pixels arranged in a first direction substantially corresponding to a direction of arrangement of a nozzle of the recoding head.

Claims 2-16. (Cancelled).

17. (Currently Amended) An image recording apparatus for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel with ~~one of N~~ a gradation value, said apparatus comprising:

an input unit for inputting image data including gradation-value information and position information relating to each pixel;

a dot-pattern-table storage unit for storing ~~[[N]]~~ a dot-pattern table, each table having a plurality of different dot patterns associated with gradation value and pixel position, ~~corresponding to respective ones of the N gradation values~~;

~~first selection means for selecting one dot-pattern table from said dot-pattern-table storage unit, based on gradation-value information~~ and position information indicated by each pixel of the image data input by said input unit; and

~~second selection means for selecting one dot pattern from the dot-pattern table selected by said first selection means, based on position information indicated by the pixel; and~~

recording control means for controlling a recording head so as to record an ink dot based on the dot pattern selected by said ~~second~~ selection means on a recording medium,

wherein the dot pattern table has a plurality of different dot patterns, each having the same dot number and a different dot arrangement, corresponding to the same gradation value, and

wherein the plurality of different dot patterns corresponding to the same gradation value are associated with a plurality of pixel positions corresponding to a plurality of pixels arranged in a first direction substantially corresponding to a direction of arrangement of a nozzle of the recording head.

Claims 18-33. (Cancelled).

34. (Currently Amended) A storage medium, capable of being read by a computer, storing program codes for executing recording control processing for an image recording apparatus for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel with ~~one of N~~ a gradation ~~values~~ value, said program codes comprising:

(a) a code of an input step for inputting image data including gradation-value information and position information relating to each pixel;

(b) a code of a ~~first~~ selection step for selecting one dot-pattern ~~table~~ based on gradation-value information and position information indicated by each pixel of the image data input in said input step, from ~~among N~~ a dot-pattern ~~tables~~, ~~each~~ table having a

plurality of different dot patterns associated with gradation value and pixel position;

corresponding to respective ones of the N gradation values; and

~~(c) a code of a second selection step for selecting one dot pattern based on position information indicated by the pixel, from the dot-pattern table selected in said first selection step; and~~

~~(d) a code of an outputting step for outputting the dot pattern selected in said second selection step,~~

wherein the dot pattern table has a plurality of different dot patterns, each having the same dot number and a different dot arrangement, corresponding to the same gradation value, and

wherein the plurality of different dot patterns corresponding to the same gradation value are associated with a plurality of pixel positions corresponding to a plurality of pixels arranged in a first direction substantially corresponding to a direction of arrangement of a nozzle of the recording head.

35. (Currently Amended) An image processing method for outputting a dot pattern corresponding to each gradation value, based on image data representing each pixel with ~~one of N a gradation values value,~~ said method comprising the steps of:

an input step for inputting image data including gradation-value information and position information relating to each pixel; and

a first selection step for selecting one dot-pattern ~~table~~ based on gradation-value information and position information indicated by each pixel of the image data input in said input step, from ~~among N a dot-pattern tables, each table~~ having a plurality of

different dot patterns associated with gradation value and pixel position ,corresponding to respective ones of the N gradation values;

~~a second selection step for selecting one dot pattern based on position information indicated by the pixel, from the dot-pattern table selected in said first selection step;~~  
and

~~an output step for outputting the dot pattern selected in said second selection step~~

wherein the dot pattern table has a plurality of different dot patterns each having the same dot number and a different dot arrangement, corresponding to the same gradation value, and

the plurality of different dot patterns corresponding to the same gradation value are associated with a plurality of pixel positions so that the plurality of different dot patterns are assigned to a plurality of pixels arranged in a recording direction and the plurality of different dot patterns are assigned to a plurality of pixels arranged in a direction orthogonal to the recording direction.

36. (Currently Amended) An image processing method according to Claim 35, wherein ~~each of the~~  $[[N]]$  dot-pattern ~~tables~~ table is a two-dimensional table expanding in a first direction substantially corresponding to a direction of arrangement of nozzles of the recording head and in a second direction substantially corresponding to a moving direction of the recording head, and wherein the dot pattern is a two-dimensional pattern expanding in the first direction and in the second direction.

37. (Original) An image processing method according to Claim 36, wherein, when sizes of the dot-pattern table in the first direction and the second direction are represented by L and K, and sizes of the dot-pattern table in the first direction and the second direction are represented by l and k, respectively, the size of the dot-pattern table and the size of the dot pattern have relationships of  $L = \alpha \times l$  ( $\alpha$  is a natural number), and  $K = \beta \times k$  ( $\beta$  is a natural number), and wherein  $\alpha$  dot patterns and  $\beta$  dot patterns having the same gradation value are stored in the first direction and the second direction, respectively, in the dot-pattern table.

38. (Original) An image processing method according to Claim 37, wherein the dot-pattern table is repeatedly used at every L pixels in the first direction, and at every K pixels in the second direction.

39. (Original) An image processing method according to Claim 37, wherein a number of cells L of the dot-pattern table in the first direction and a number of nozzles A of the recording head have a relationship of  $L = \alpha \times A$  ( $\alpha$  is a natural number).

40. (Original) An image processing method according to Claim 37, wherein, when the position information indicated by the pixel is represented by two-dimensional coordinates (x, y), and the x coordinate and the y coordinate correspond to the second direction and the first direction, respectively, the dot pattern selected in said second selection step is a dot pattern at a position specified based on the x coordinate value, the y coordinate value, the value  $\alpha$ , and the value  $\beta$  within the dot-pattern table.

41. (Original) An image processing method according to Claim 37, wherein the dot-pattern table is determined in consideration of characteristics of each of a plurality of nozzles of the recording head.

42. (Currently Amended) An image processing method according to Claim 41, wherein a number of dot-pattern tables determined in consideration of the characteristics of each of the nozzles, from among ~~the~~ N dot-pattern tables provided for corresponding ones of ~~the~~ N gradation values, is H ( $N > H$ , H is a natural number).

43. (Original) An image processing method according to Claim 41, wherein the dot-pattern table determined in consideration of the characteristics of each of the nozzles is a dot-pattern table corresponding to a gradation value such that a ratio of dots D (%) provided within a pixel is within a range of  $25 < D < 50$ .

44. (Original) An image processing method according to Claim 37, wherein cells in the second direction from among cells positioned at end portions of the dot-pattern table do not include dot information.

45. (Original) An image processing method according to Claim 37, wherein the gradation value of a dot pattern positioned at an end portion of the dot-pattern table in the second direction is smaller than the gradation value indicated by the dot-pattern table where the dot pattern is stored.

46. (Original) An image processing method according to Claim 37, wherein the dot-pattern table has a blue-noise characteristic.

47. (Original) An image processing method according to Claim 46, wherein the blue-noise characteristic is a characteristic in which a power spectrum in a low-frequency region of an image recorded based on the image data is smaller than a power spectrum of a high-frequency region.

48. (Original) An image recording apparatus for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel by one of N gradation values, said apparatus comprising:

an input unit for inputting image data including gradation-value information and position information relating to each pixel;

selection means for selecting one dot pattern based on gradation-value information and position information indicated by each pixel of the image data input by said input unit, from a dot-pattern-table storage unit for storing X ( $N > X$ , X is a natural number) dot patterns, each having a plurality of different dot patterns, corresponding to respective ones of X gradation values; and

dot-pattern generation means for generating dot patterns corresponding to (N - X) predetermined gradation values,

wherein, when a dot-pattern table corresponding to the gradation-value information is stored in the dot-pattern-table storage unit, the dot pattern selected by said selection means is recorded by a recording head, and



wherein, when a dot-pattern table corresponding to the gradation-value information is not stored in the dot-pattern-table storage unit, dot patterns corresponding to the predetermined gradation values generated by said dot-pattern generation means are recorded by the recording head.

49. (Original) An image recording apparatus according to Claim 48, wherein the dot pattern generated by said dot-pattern generation means is a dot pattern having a fixed dot arrangement.

50. (Original) An image recording apparatus according to Claim 49, wherein the dot pattern generated by said dot-pattern generation means is a dot pattern in which no dot is recorded on all dot positions.

51. (Original) An image recording apparatus according to Claim 49, wherein the dot pattern generated by said dot-pattern generation means is a dot pattern in which dots are recorded on all dot positions.

52. (Currently Amended) An image recording apparatus for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel by one of N gradation values, said apparatus comprising:

an input unit for inputting image data including gradation-value information and position information relating to each pixel;

a dot-pattern-table storage unit for storing  $X$  ( $N > X$ ,  $X$  is a natural number) dot-pattern tables, each having a plurality of different dot patterns, corresponding to respective ones of  $X$  gradation values;

first selection means for selecting one dot pattern from said dot-pattern-table storage unit, based on gradation-value information indicated by each pixel of the image data input by said input unit;

a second selection means for selecting one ~~do~~ dot pattern from the dot-pattern table selected by said first selection means, based on position information indicated by the pixel; and

dot-pattern generation means for generating dot patterns corresponding to  $(N - X)$  predetermined gradation values,

wherein the dot-pattern table is a two-dimensional table expanding in a first direction corresponding to a direction of arrangement of nozzles of the recording head and in a second direction different from the first direction,

wherein a number of cells  $L$  within the dot-pattern table in the first direction and a number of nozzles  $A$  of the recording head have a relationship of  $L = \alpha \times A$  ( $\alpha$  is a natural number),

wherein, when a dot-pattern table corresponding to the gradation-value information is stored in said dot-pattern-table storage unit, the dot pattern selected by said second selection means is recorded by a recording head, and

wherein, when a dot-pattern table corresponding to the gradation-value information is not stored in said dot-pattern-table storage unit, the dot patterns corresponding to

the predetermined gradation values generated by said dot-pattern generation means are recorded by the recording head.

Claims 53-55. (Cancelled).

56. (Original) An image recording apparatus for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel with one of  $N$  ( $N$  is an integer equal to or larger than 3) gradation values, said apparatus comprising:

an input unit for inputting image data including gradation-value information and position information relating to each pixel;

a dot-pattern-table storage unit for storing  $X$  ( $N > X$ ,  $X$  is a natural number) dot-pattern tables, each having a plurality of different dot patterns, corresponding to  $X$  gradation values provided at intervals of every other gradation level;

first selection means for selecting one dot-pattern table from said dot-pattern-table storage unit, based on gradation-value information indicated by each pixel of the image data input by said input unit;

second selection means for selecting one dot pattern based on position information indicated by the pixel, from the dot-pattern table selected by said first selection means; and

dot-pattern interpolation means for generating dot patterns corresponding to  $(N - X)$  predetermined gradation values, based on a dot pattern within the dot-pattern table corresponding to a gradation value larger than a corresponding one of the

predetermined gradation values by one, and a dot pattern within the dot-pattern table corresponding to a gradation value smaller than the corresponding one of the predetermined gradation values by one,

wherein the dot-pattern table is a two-dimensional table expanding in a first direction corresponding to a direction of arrangement of nozzles of the recording head and in a second direction different from the first direction,

wherein a number of cells  $L$  within the dot-pattern table in the first direction and a number of nozzles  $A$  of the recording head have a relationship of  $L = \infty \times A$  ( $\infty$  is a natural number),

wherein, when a dot-pattern table corresponding to the gradation-value information is stored in said dot-pattern-table storage unit, the dot pattern selected by said second selection means is recorded by a recording head, and

wherein, when a dot-pattern table corresponding to the gradation-value information is not stored in said dot-pattern-table storage unit, the dot patterns corresponding to the predetermined gradation values generated by said dot-pattern interpolation means are recorded by the recording head.

Claims 57-59. (Cancelled).

60. (Original) An image recording method for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel by one of  $N$  gradation values, said method comprising the steps of:

an input step for inputting image data including gradation-value information and position information relating to each pixel;

a selection step for selecting one dot pattern based on gradation-value information and position information indicated by each pixel of the image data input in said input step, from a dot-pattern-table storage unit for storing  $X$  ( $N > X$ ,  $X$  is a natural number) dot patterns, each having a plurality of different dot patterns, corresponding to respective ones of  $X$  gradation values, and

a dot-pattern generation step for generating dot patterns corresponding to  $(N - X)$  predetermined gradation values,

wherein, when a dot-pattern table corresponding to the gradation-value information is stored in the dot-pattern-table storage unit, the dot pattern selected in said selection step is recorded by a recording head, and

wherein, when a dot-pattern table corresponding to the gradation-value information is not stored in the dot-pattern-table storage unit, the dot patterns corresponding to the predetermined gradation values generated in said dot-pattern generation step are recorded by the recording head.

Claims 61-63. (Cancelled).

64. (Original) An image recording method for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel by one of  $N$  gradation values, said method comprising the steps of:

an input step for inputting image data including gradation-value information and position information relating to each pixel;

a first selection step for selecting one dot pattern based on gradation-value information indicated by each pixel of the image data input in said input step, from a dot-pattern-table storage unit for storing  $X$  ( $N > X$ ,  $X$  is a natural number) dot patterns, each having a plurality of different dot patterns, corresponding to respective ones of  $X$  gradation value;

a second selection step for selecting one dot pattern from the dot-pattern table selected in said first selection step, based on position information indicated by the pixel; and

a dot-pattern generation step for generating dot patterns corresponding to  $(N - X)$  predetermined gradation values,

wherein the dot-pattern table is a two-dimensional table expanding in a first direction corresponding to a direction of arrangement of nozzles of the recording head and in a second direction different from the first direction,

wherein a number of cells  $L$  within the dot-pattern table in the first direction and a number of nozzles  $A$  of the recording head have a relationship of  $L = \infty \times A$  ( $\infty$  is a natural number),

wherein, when a dot-pattern table corresponding to the gradation-value information is stored in the dot-pattern-table storage unit, the dot pattern selected in said second selection step is recorded by a recording head, and

wherein, when a dot-pattern table corresponding to the gradation-value information is not stored in the dot-pattern-table storage unit, the dot patterns corresponding to

the predetermined gradation values generated in said dot-pattern generation step are recorded by the recording head.

Claims 65-67. (Cancelled).

68. (Original) An image recording method for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel with one of  $N$  ( $N$  is an integer equal to or larger than 3) gradation values, said method comprising the steps of:

an input step for inputting image data including gradation-value information and position information relating to each pixel;

a first selection step for selecting one dot-pattern table based on gradation-value information indicated by each pixel of the image data input in said input step, from a dot-pattern-table storage unit for storing  $X$  ( $N > X$ ,  $X$  is a natural number) dot-pattern tables, each having a plurality of different dot patterns, corresponding to  $X$  gradation values provided at intervals of every other gradation level

a second selection step for selecting one dot pattern based on position information indicated by the pixel, from the dot-pattern table selected in said first selection step; and

a dot-pattern interpolation step for generating dot patterns corresponding to  $(N - X)$  predetermined gradation values, based on a dot pattern within a dot-pattern table corresponding to a gradation value larger than a corresponding one of the predetermined gradation values by one, and a dot pattern within a dot-pattern table corresponding

to a gradation value smaller than the corresponding one of the predetermined gradation values by one,

wherein the dot-pattern table is a two-dimensional table expanding in a first direction corresponding to a direction of arrangement of nozzles of a recording head and in a second direction different from the first direction,

wherein a number of cells  $L$  within the dot-pattern table in the first direction and a number of nozzles  $A$  of the recording head have a relationship of  $L = \infty \times A$  ( $\infty$  is a natural number),

wherein, when a dot-pattern table corresponding to the gradation-value information is stored in the dot-pattern-table storage unit, the dot pattern selected in said second selection step is recorded by a recording head, and

wherein, when a dot-pattern table corresponding to the gradation-value information is not stored in the dot-pattern-table storage unit, the dot patterns corresponding to the predetermined gradation values generated in said dot-pattern interpolation step are recorded by the recording head.

Claims 69-77. (Cancelled).

78. (Original) An image recording apparatus for outputting dot patterns corresponding to respective gradation values and recording the output dot patterns using recording materials having a plurality of colors by a recording unit, based on image data representing each pixel with one of  $N$  gradation values, said apparatus comprising:



an input unit for inputting image data including position information, gradation-value information and color information relating to each pixel;

a dot-pattern-table storage unit for storing N dot-pattern tables, each having a plurality of different dot patterns, corresponding to respective ones of the N gradation values, for each color of the recording materials; and

an output unit for outputting one dot pattern from said dot-pattern-table storage unit, based on position information, gradation-value information and color information indicated by each pixel of the image data input by said input unit,

wherein a size of a dot-pattern table corresponding to at least one specific color from among the dot-pattern tables stored for each of the plurality of colors is smaller than sizes of dot-pattern tables corresponding to colors other than the specific color.

79. (Original) An image recording apparatus according to Claim 78, wherein the specific color is a color having relatively high lightness from among the plurality of colors.

80. (Original) An image recording apparatus according to Claim 78, wherein the colors of the recording materials are four colors, i.e., cyan, magenta, yellow and black, and wherein the specific color is yellow.

81. (Original) An image recording apparatus according to Claim 78, wherein the colors of the recording materials are six colors, i.e., cyan, light cyan, magenta, light

magenta, yellow and black, and wherein the specific colors are light cyan, light magenta, and yellow.

82. (Original) An image recording apparatus according to Claim 78, wherein the recording material is ink, and wherein the recording unit is an ink-jet recording head for performing recording by discharging the ink.

83. (Original) An image recording apparatus according to Claim 82, wherein the ink-jet recording head is a head for discharging the ink utilizing thermal energy, and comprises a thermal-energy transducer for generating the thermal energy to be provided to the ink.

84. (Original) An image recording method for outputting dot patterns corresponding to respective gradation values and recording the output dot patterns using recording materials having a plurality of colors by a recording unit, based on image data representing each pixel with one of N (N is an integer equal to or larger than 2) gradation values, said method comprising the steps of:

an input step for inputting image data including position information, gradation-value information and color information relating to each pixel;

an output step for outputting one dot pattern based on position information, gradation-value information and color information indicated by each pixel of the image data input in said input step, from a dot-pattern-table storage unit for storing N dot

patterns, each having a plurality of different dot patterns, corresponding to respective ones of the N gradation values, for each color of the recording materials; and

a recording step for recording the dot pattern output in said output step by the recording unit,

wherein a size of a dot-pattern table corresponding to at least one specific color from among the dot-pattern tables stored for each of the plurality of colors is smaller than sizes of dot-pattern tables corresponding to colors other than the specific color.

Claims 85-89. (Cancelled).

90. (New) An image recording method for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel with a gradation value, said method comprising the steps of:

an input step for inputting image data including gradation value information and position information relating to each pixel;

a selection step for selecting one dot pattern based on gradation value information and position information indicated by each pixel on the image data input in said input step, from a dot pattern table having a plurality of different dot patterns associated with gradation value and pixel position; and

a recording step for recording an ink dot based on the dot pattern selected in said selection step on a recording medium using a recording head,

wherein the dot pattern table has a plurality of different dot patterns, each having the same dot number and a different dot arrangement, corresponding to the same gradation value, and

wherein the dot pattern table is repeatedly used at each of a plurality of pixels in a first direction substantially corresponding to a direction of arrangement of nozzle of the recording head.

91. (New) An image recording method for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel with a gradation value, said method comprising the steps of:

an input step for inputting image data including gradation value information and position information relating to each pixel;

a selection step for selecting one dot pattern based on gradation value information and position information indicated by each pixel on the image data input in said input step, from a dot pattern table having a plurality of different dot patterns associated with gradation value and pixel position; and

a recording step for recording an ink dot based on the dot pattern selected in said selection step on a recording medium using a recording head,

wherein the dot pattern table has a plurality of different dot patterns, each having the same dot number and a different dot arrangement, corresponding to the same gradation value, and

wherein the dot pattern table is repeatedly used at each of a plurality of pixels in a second direction substantially orthogonal to a direction of arrangement of a nozzle of the recoding head.

92. (New) An image recording method for performing recording using a dot pattern corresponding to each gradation value, based on image data representing each pixel with one of gradation values, said method comprising the steps of:

an input step for inputting image data including gradation value information and position information relating to each pixel;

a selection step for selecting one dot pattern based on gradation value information and position information indicated by each pixel on the image data input in said input step, from a dot pattern table having a plurality of different dot patterns associated with gradation value and pixel position; and

a recording step for recording an ink dot based on the dot pattern selected in said selection step on a recording medium using a recording head,

wherein the dot pattern table has a plurality of different dot patterns, each having the same dot number and a different dot arrangement, corresponding to the same gradation value, and

wherein the dot pattern table is repeatedly used at each of a plurality of pixels in a first direction substantially corresponding to a direction of arrangement of a nozzle of the recording head and is repeatedly used at each of a plurality of pixels in a second direction orthogonal to the first direction.